



Case Report

Fatal thromboembolic disease: A risk in physically restrained psychiatric patients

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ABSTRACT

Objective: Physical restraint is used in circumstances where patients exhibit behavior deemed threatening to their health and/or those around them. This practice has been associated with morbidity and mortality in the context of police custody, hospitals and long-term care facilities. While most of these events relate to short-term immobilization, the risks associated with prolonged physical restraint of psychiatric patients are largely unknown.

Method: A retrospective review was performed at the Provincial Forensic Pathology Unit for cases of death occurring in physically restrained psychiatric patients.

Result: We identified three patients who were immobilized by 4 point, 3-to-5 point and waist physical restraints. The immobilization periods ranged from 3 to 5 days. On autopsy, occlusive pulmonary thromboemboli were identified in each patient. None of the patients had previously recognized coagulopathies or significant risk factors for deep vein thrombosis. Postmortem genetic studies for Factor V and prothrombin mutations were negative.

Discussion: Deep vein thrombosis is likely an under recognized occurrence in physically restrained patients under psychiatric care. We propose that deep vein thrombosis and pulmonary embolism be recognized as a risk factor for prolonged physical restraint. As a result, prospective studies examining the incidence and prevention of this adverse outcome is indicated.

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1. Introduction

Physical restraint represents an aggressive intervention intended to restrict voluntary activity—without the objective of addressing an underlying medical condition *per se*. The application of physical restraints in acute and long-term care facilities is variable¹ and in some circumstances remains common place.^{2–4} Recent attention has been directed towards sudden death arising in the context of short-term physical restraint, particularly under the jurisdiction of law enforcement. The cause of death in these situations may be complicated, and have a number of potential mechanisms, such as: exacerbation of an underlying medical condition,⁵ strangulation,⁶ drugs/medication,⁷ asphyxia,⁸ and excited delirium.^{9,10}

Chronic immobility has long been associated with an increased risk of deep vein thrombosis (DVT) and pulmonary embolism (PE),¹¹ the outcome of which is not infrequently fatal. Herein we describe three cases of sudden death resulting from PE in psychiatric patients undergoing prolonged physical restraint. The purpose

of this report is to contribute to understanding the pathophysiology of sudden death under physical restraint and alert clinicians to this poorly understood, albeit potentially preventable, outcome.

2. Methods

A retrospective review of the records of the Office of the Chief Coroner for Ontario, Canada were conducted for cases of fatal pulmonary embolism occurring in physically restrained psychiatric patients. Between January 2000 and August 2006 three cases fulfilling these criteria were identified. In each case there was a thorough external and internal postmortem examination, histopathological analysis, blood and urine toxicological screen and molecular studies for Factor V Leiden and prothrombin mutations.

3. Results

3.1. Case reports

3.1.1. Case 1

A 34-year-old black male with a history of bipolar affective disorder and antisocial personality disorder was admitted to a

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psychiatric hospital for management of an acute psychotic decompensation. His medications included risperidone, and loxapine. He smoked cigarettes. There was no history of drug abuse. In hospital he was placed in four-point physical restraints, with intermittent release, for a period of five days. Upon his final release, he was being escorted to the washroom where he complained of dizziness and then collapsed. He was resuscitated and transferred to another hospital, but died less than 1 h later.

Autopsy revealed an obese male (121.1 kg/1.85 m; body mass index (BMI) = 35.4 kg/m²), with a saddle embolus completely occluding the right and left pulmonary arteries. The thrombus was firm and showed prominent lines of Zahn. The upper and lower extremities were symmetrical; dissection of the latter failed to identify residual thrombosis of the femoral veins or deep veins of the lower limbs. Within the inferior vena cava there were several one-to-three centimeter venous thrombi. The remainder of the autopsy was unremarkable. The cause of death was reported as acute pulmonary thromboembolism in a man previously restrained by physical means.

3.1.2. Case 2

A 38-year-old black male with a history of bipolar affective disorder was poorly compliant with his medications and admitted to hospital in a psychotic state. His medications included clozapine, lithium and amitriptyline. There was no history of drug abuse. In hospital he received loxapine and lorazepam, and was placed in three-to-five point physical restraints. Four days after admission he was noted to have an elevated respiratory rate, immediately preceding death. A resuscitation attempt was unsuccessful.

Autopsy revealed an overweight male (83.5 kg/1.78 m; body mass index (BMI) = 26.4 kg/m²). The soft tissues of the right ankle had a small region of subcutaneous hemorrhage. There were occlusive thromboemboli in the right and left pulmonary arteries, bilaterally. Dissection of the deep veins revealed deep vein thrombosis of the posterior tibial veins bilaterally. The cause of death was reported as pulmonary thromboemboli in a man treated with physical restraints.

3.1.3. Case 3

A 73-year-old white woman with a history of dementia, depression and unspecified heart problems was admitted from home to a crisis unit with increasing paranoia, agitation and aggression. Her medications included venlafaxine, galantamine, propafenone and clonazepam. She did not drink alcohol. Upon admission she was reported to be physically aggressive towards medical staff and other patients. She was treated with risperidone, olanzapine, methotrimeprazine and ativan. Her family objected to what they felt was excessive chemical sedation; consequently, this was lessened in exchange for physical restraint in the form of a waist belt. Three days after admission the patient woke, consumed a small meal and was taken to the washroom where she suddenly collapsed. Despite a full resuscitation, she could not be revived.

Autopsy revealed a female with truncal obesity (79.3 kg/height not available) and acute bilateral pulmonary thromboembolism, with multiple thromboemboli distributed throughout the secondary and tertiary branches of the pulmonary arterial circulation. Dissection of the deep veins in the legs showed patchy occlusive thrombosis of the left popliteal vein and intra-muscular veins of both gastrocnemius muscles. Histologic examination of the brain revealed Alzheimer's disease and argyrophilic grain disease. The cause of death was reported as acute pulmonary thromboembolism as a complication of physical restraints used for agitation secondary to dementia.

4. Discussion

We present the postmortem findings of three psychiatric patients who received prolonged physical restraint in the course of their hospital admissions, and had sudden unexpected deaths. Each case had in common a history of mental illness and behavior on admission that was deemed to necessitate physical restraint. While all of the patients were to some degree overweight, none had a history of thrombophilia. Death in each case was precipitous, and autopsy confirmed the presence of obstructive pulmonary thromboembolic disease. Histopathologic examination and toxicology screens failed to reveal underlying contributors; similarly, molecular studies failed to identify testable mutations leading to a hypercoagulable state. Thus, in each case the presumed cause of death was pulmonary embolism as a complication of prolonged physical restraint.

Certain subsets of psychiatric patients – including those with bipolar disorder and schizophrenia – have been suggested to possess an increased risk of thromboembolic disease.^{12,13} While a precise pathophysiologic basis to explain these observations remains elusive, it is most likely multifactorial in origin. It has been suggested that risk factors associated with the underlying condition may contribute to this incidence (e.g., catatonia/stupor,¹³ dehydration/hypovolemia, recreational drug use and smoking,^{13,14} or the effects of prescribed medications^{14–16}).

Haemodynamic changes in blood flow as a result of prolonged physical immobilization is associated with an increased risk of thromboembolism; this has, for example, long been known to occur in the context of spinal injuries.¹⁷ According to “Virchow's Triad” immobilization of the limbs results in decreased venous blood return by the loss of pumping effect from muscle activity; consequently, blood may be allowed to pool and clot.¹⁷ Moreover, tethering of the limbs may be associated with soft tissue injury to the extremities. Conceivably, if there is concomitant vascular endothelial damage, this may potentiate the risk of clot formation.

Only recently did the first report of pulmonary embolism in physically restrained psychiatric patients emerge.⁴ A review of the English medical literature yields two additional reports (Table 1);^{3,18} our study therefore represents the largest series to date on

Table 1

Summary of cases of DVT/PE occurring in psychiatric patients treated by physical restraint reported in the English medical literature between 1966 and present.

Author	Age	Sex	Underlying condition	Length of restraint	Death
Present	73	Female	Alzheimer's	3 days	Yes
	38	Male	Bipolar	4 days	Yes
	34	Male	Bipolar	5 days	Yes
Hem ⁴	29	Male	Schizophrenia	11 + 4 ^a	No
	59	Male	Bipolar	3 days	Yes
Lazarus ¹⁸	37	Male	Schizophrenia	8 days	Yes
	70	Female	Bipolar	4 days	Yes
Laursen ³	27	Male	Delusional	10 days	No

^a Periods of restraint briefly separated.

this phenomenon. Other sources, such as the non-English medical literature,^{19,20} legal literature²¹ and media²² suggest this phenomenon may, in fact, be grossly underestimated.

Immobilization of psychiatric patients using physical and/or chemical restraint is controversial.^{23,24} While short term physical restraint may have a role in restricted circumstances,²⁵ the efficacy of prolonged restraint is less certain.^{26–29} We report three cases of sudden death due to thromboembolic disease in psychiatric patients that are directly attributable to prolonged physical restraint. The pathogenesis is presumed to be the result of venous stasis and possibly exacerbated by contributions from the underlying medical condition and/or interventions associated with treatment. Venous thrombosis and small pulmonary emboli may be clinically silent; therefore, our observations likely represent an underestimate of the actual incidence of this phenomenon in physically restrained psychiatric patients. At present there is limited published data on physical restraint practices in Ontario;³⁰ clearly, there is a need to better document and report the number of psychiatric patients restrained, as well as morbidity and mortality arising from such practices. An awareness of this adverse complication amongst health care professionals is essential to limit the application of physical restraints, and improve evaluation and monitoring in instances where immobilization is unavoidable. Similarly, clinical trials evaluating the potential benefits from application of preventative measures such as compression stockings or prophylactic anticoagulation merit consideration.

Conflict of interest statement

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Ethical approval

None declared.

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